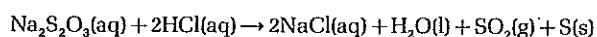


8.8 Temperature and reaction rate

Reaction rate varies with temperature. This variation can be conveniently studied by investigating the reaction between sodium thiosulphate solution and dilute hydrochloric acid.



The amount of sulphur precipitate increases during the reaction. This results in the reaction mixture becoming increasingly cloudy.

Aim

To investigate the effect of temperature on the rate of reaction between sodium thiosulphate solution and dilute hydrochloric acid.

Apparatus and materials

Conical flask, 100 cm³
Stopclock or timer
Measuring cylinder, 100 cm³
Measuring cylinder, 25 cm³
Thermometer, -10 to +110°C
Bunsen burner and mat
Tripod and gauze
Sheet of white paper
Graph paper
Dilute hydrochloric acid, 2 mol dm⁻³
Sodium thiosulphate solution, 40 g dm⁻³

Procedure

- 1 Use the larger measuring cylinder to pour 40 cm³ of water into the conical flask.
- 2 Use the smaller measuring cylinder to add 10 cm³ of sodium thiosulphate solution to the conical flask. Swirl the flask to mix the thiosulphate and water.
- 3 Wash out the smaller measuring cylinder thoroughly with water. Measure out 5 cm³ of dilute hydrochloric acid.
- 4 Place the flask on a tripod and gauze and heat the thiosulphate solution to 30°C.
- 5 Place the flask on a piece of paper marked with a cross.
- 6 Add 5 cm³ of dilute hydrochloric acid. Swirl the flask and start the timer.
- 7 Measure the temperature of the mixture.
- 8 Look through the solution. Stop the timer when the cross on the paper disappears.

- 9 Rinse out the conical flask and repeat steps 1–8 five more times heating the flask containing the sodium thiosulphate solution to 40, 50, 60, 70 and finally 80°C.

Results

Copy and complete the following table:

starting temperature/°C	final temperature/°C	time/s	time ⁻¹ /s ⁻¹
30			
40			
50			
60			
70			
80			

Plot graphs of:

- i) starting temperature (on the vertical axis) against time (on the horizontal axis)
- ii) starting temperature (on the vertical axis) against 1/time (on the horizontal axis).

Questions

- 1 a) How does temperature affect the speed of the reaction?
b) Why must the volumes of sodium thiosulphate solution and dilute hydrochloric acid remain constant for each part of the experiment?
c) If the sodium thiosulphate solution started to go cloudy before you added the acid what could the reason be?
d) How would you show that the yellow solid produced in the reaction is sulphur?
e) Name the chemicals left in the flask when the experiment has finished.
- 2 Decreases in temperature slow down the rates of many chemical processes. This is particularly important for chemical processes which take place in biological systems. Give some examples of the effect of temperature on biological processes.